

Manufacturing Organization

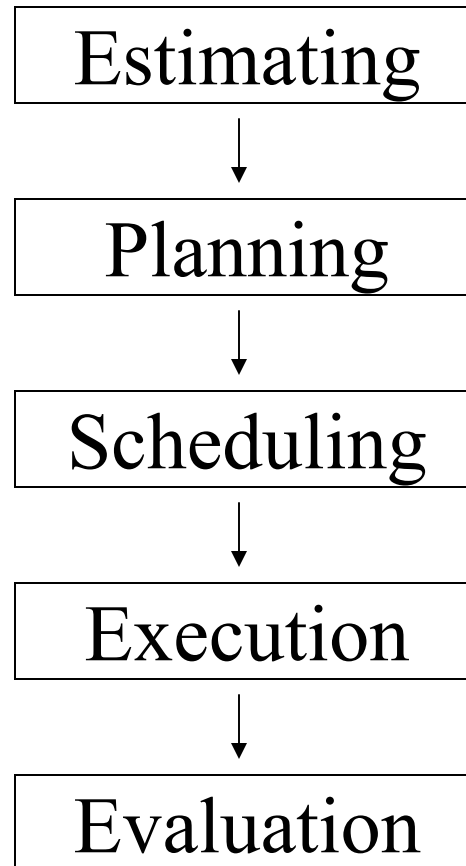
DEFINITION

MANUFACTURE:

TO MAKE OR PROCESS (A RAW MATERIAL) INTO A FINISHED PRODUCT, ESPECIALLY BY A LARGESCALE INDUSTRIAL OPERATION. TO MAKE OR PROCESS (A PRODUCT), ESPECIALLY WITH INDUSTRIAL MACHINES.

- Webster's II New University Dictionary, Houghton Mifflin, Boston, 1984

INDUSTRIAL PROCESS MANAGEMENT CYCLE



Product Life Cycle

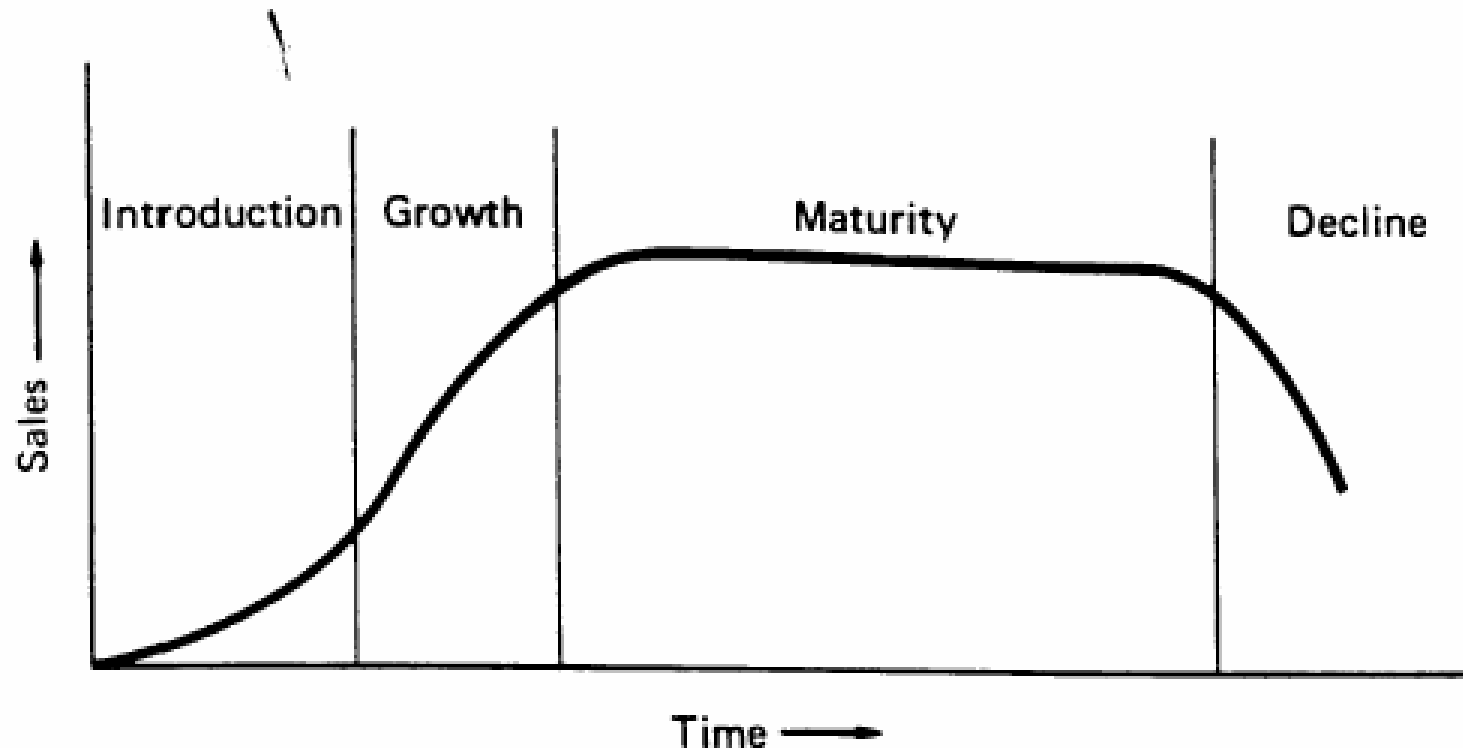


Figure 1-8 Product life cycle.

The Materials Cycle

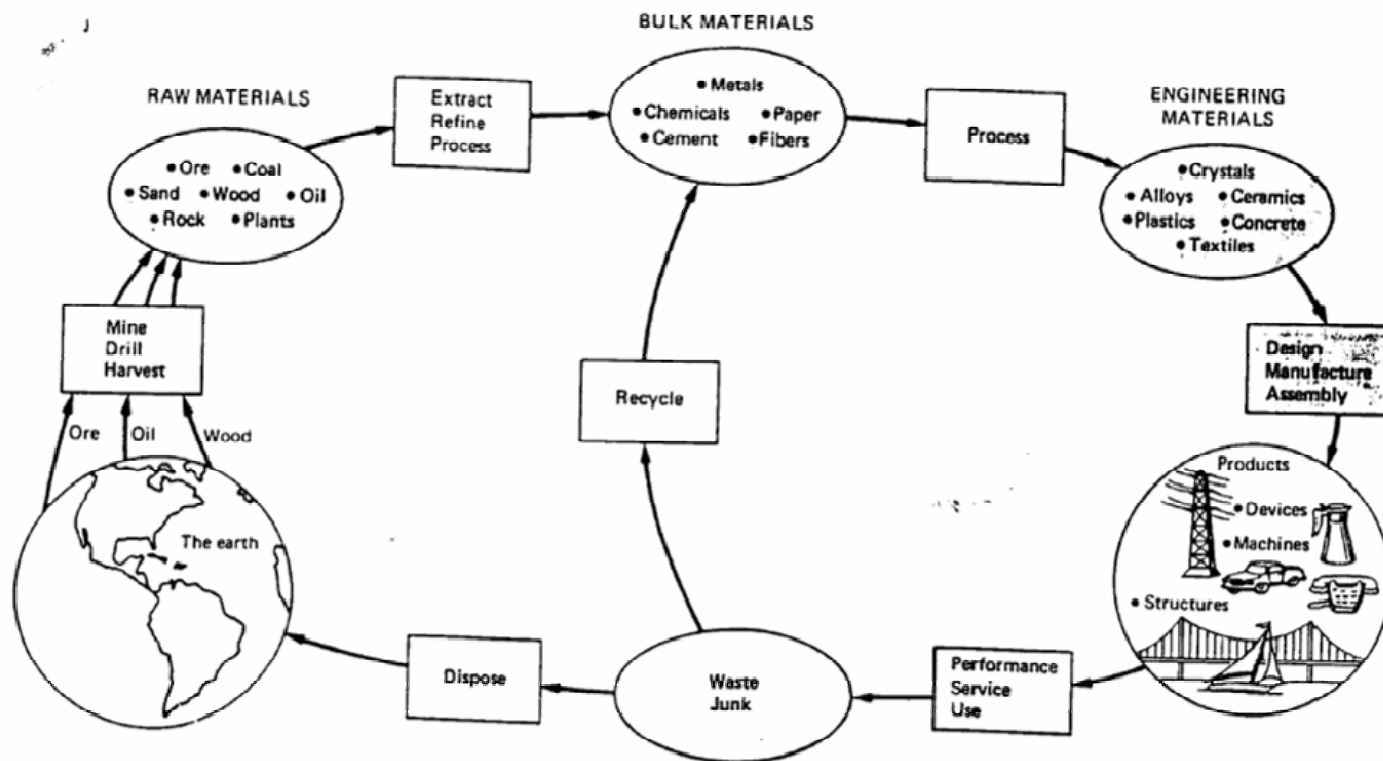


Figure 1-11 The total materials cycle. (Reproduced from "Materials and Man's Needs," National Academy of Sciences, Washington, D.C., 1974.)

Manufacturing Management History

1. Artisan
2. Industrial Revolution
3. Mass Production
“Henry Ford”
4. Scientific Management
“Taylorism”
5. World Class Manufacturing
“Toyota”
6. Lean Production
7. ?

The Principles of Scientific Management

- It is true that whenever intelligent and educated men find that the responsibility for making progress in any of the mechanic arts rests with them, instead of upon the workmen who are actually laboring at the trade, that they almost invariably start on the road which leads to the development of a science where, in the past, has existed mere traditional or rule-of-thumb knowledge. When men, whose education has given them the habit of generalizing and everywhere looking for laws, find themselves confronted with a multitude of problems, such as exist in every trade and which have a general similarity one to another, it is inevitable that they should try to gather these problems into certain logical groups, and then search for some general laws or rules to guide them in their solution. As has been pointed out, however, the underlying principles of the management of “initiative and incentive,” that is, the underlying philosophy of this management, necessarily leaves the solution of all of these problems in the hands of each individual workman, while the philosophy of scientific management places their solution in the hands of the management.
- SOURCE: Taylor (1934).

Japanese Management and Technology

- The one great economic power to emerge in this century-Japan-has not been a technological pioneer in any area. Its ascendancy rests squarely on leadership in management. The Japanese understood the lessons of America's managerial achievement during World War II more clearly than we did ourselves-especially with respect to managing people as a resource rather than as a cost. As a result, they adapted the West's new "social technology"-management-to make it fit their own values and traditions. They adopted (and adapted) organization theory to become the most thorough practitioners of decentralization in the world. (Pre-World War II Japan had been completely centralized.) And they began to practice marketing when most American companies were still only preaching it.
- Japan also understood sooner than other countries that management and technology together had changed the economic landscape. The mechanical model of organization and technology, which came into being at the end of the seventeenth century when an obscure French physicist, Denis Papin, designed a prototypical steam engine, came to an end in 1945, when the first atomic bomb exploded and the first computer went on line. Since then, the model for both technology and organizations has been a biological one - interdependent, knowledge intensive, and organized by the flow of information.
- SOURCE: Drucker (1988b).

Manufacturing Company Goal

World class manufacturers have established as an operating goal that they will be world class.

They assess their performance by *benchmarking* themselves against their competition and against other world class operational functions, even in other industries.

They use this information to establish *organizational goals and objectives*, which they communicate to all members of the enterprise, and they continuously measure and assess the performance of the system against these objectives and regularly *assess the appropriateness of the objectives to attaining world class status*.

Manufacturing Company Customers

World class manufacturers instill and constantly reinforce within the organization the principle that the system and everyone in it must know their customers and must seek to satisfy the needs and wants of customers and other stakeholders.

Manufacturing Company Organization

World class manufacturers integrate all elements of the manufacturing system to satisfy the needs and wants of its customers in a timely and effective manner.

They eliminate organizational barriers to permit improved communication and to provide high quality products and services.

Manufacturing Company Employees

Employee involvement and empowerment are recognized by world class manufacturers as critical to achieving continuous improvement in all elements of the manufacturing system.

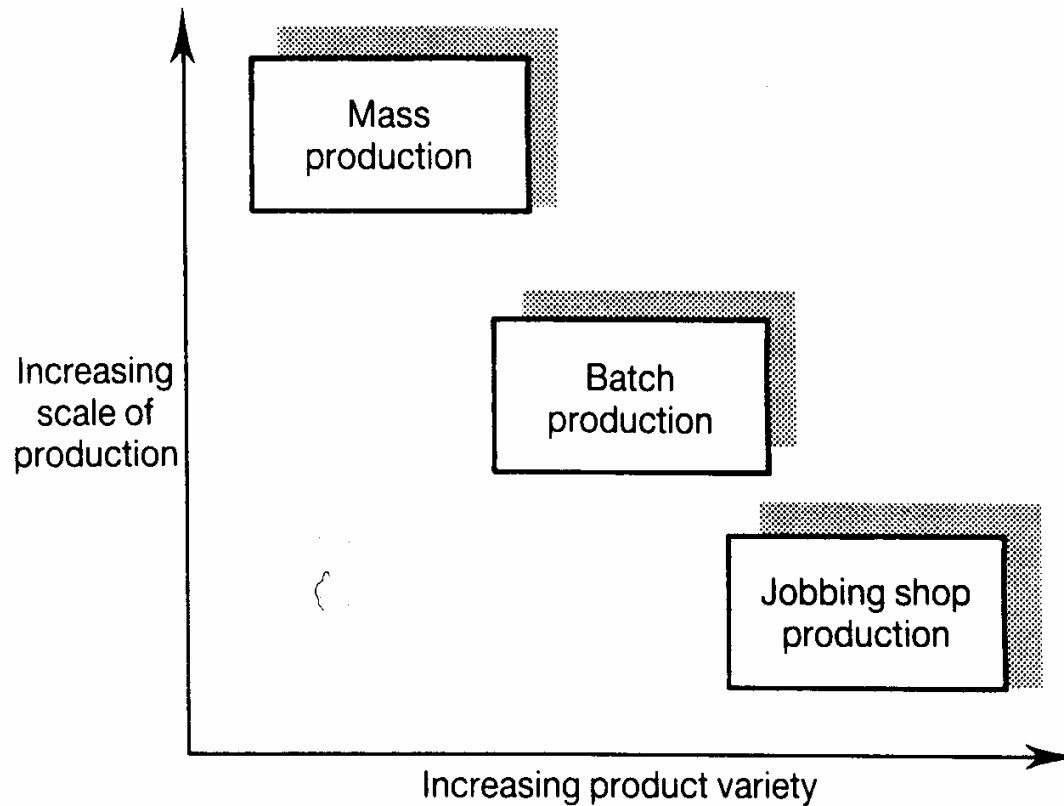
Management's opportunity to ensure the continuity of organizational development and renewal comes primarily through the involvement of the employee.

Manufacturing Company Suppliers and Vendors

World class manufacturers encourage and motivate their suppliers and vendors to become coequals with the other elements of the manufacturing system.

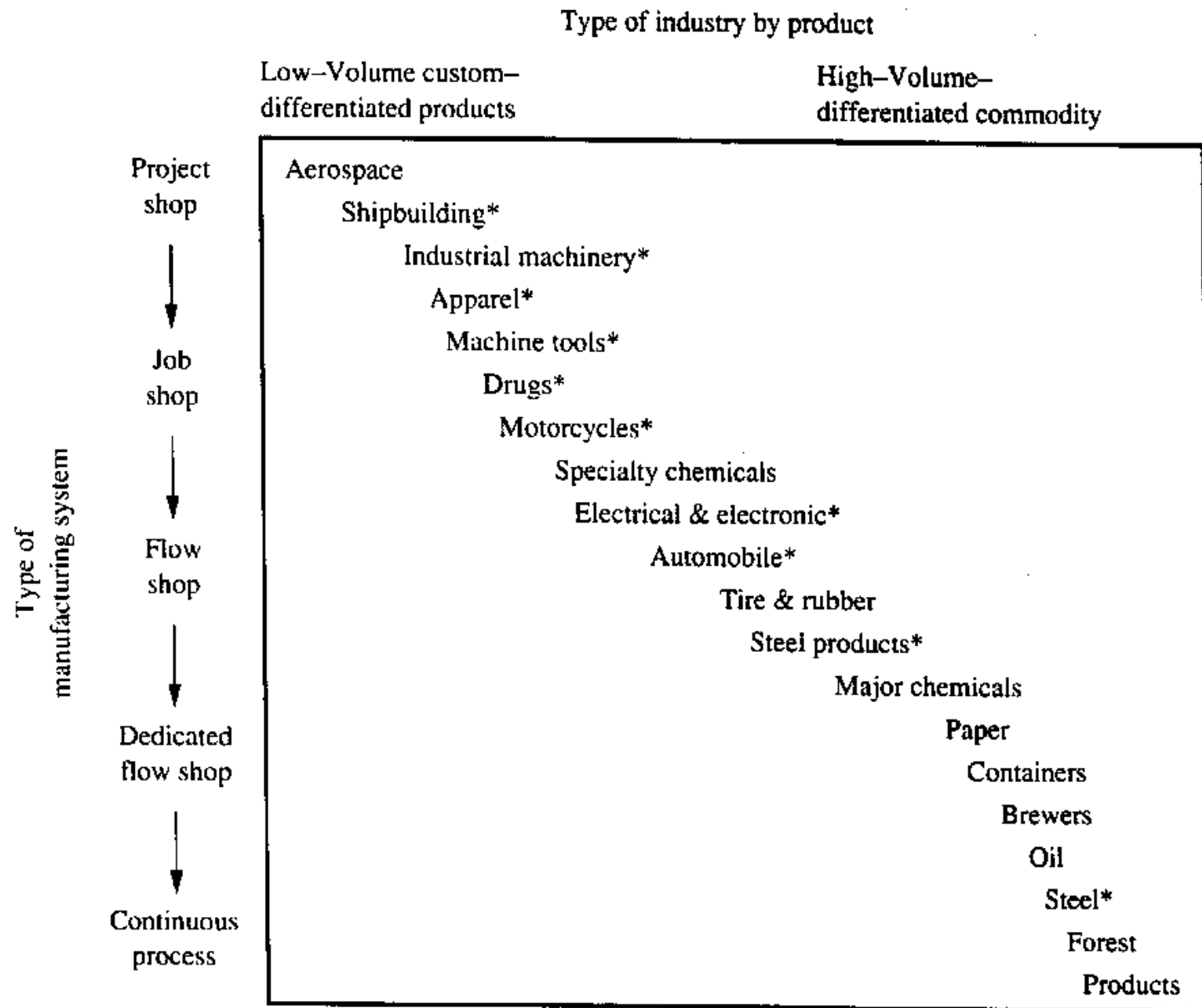
This demands a commitment and an expenditure of effort by all elements of the system to ensure their proper integration.

Classification of Discrete Production

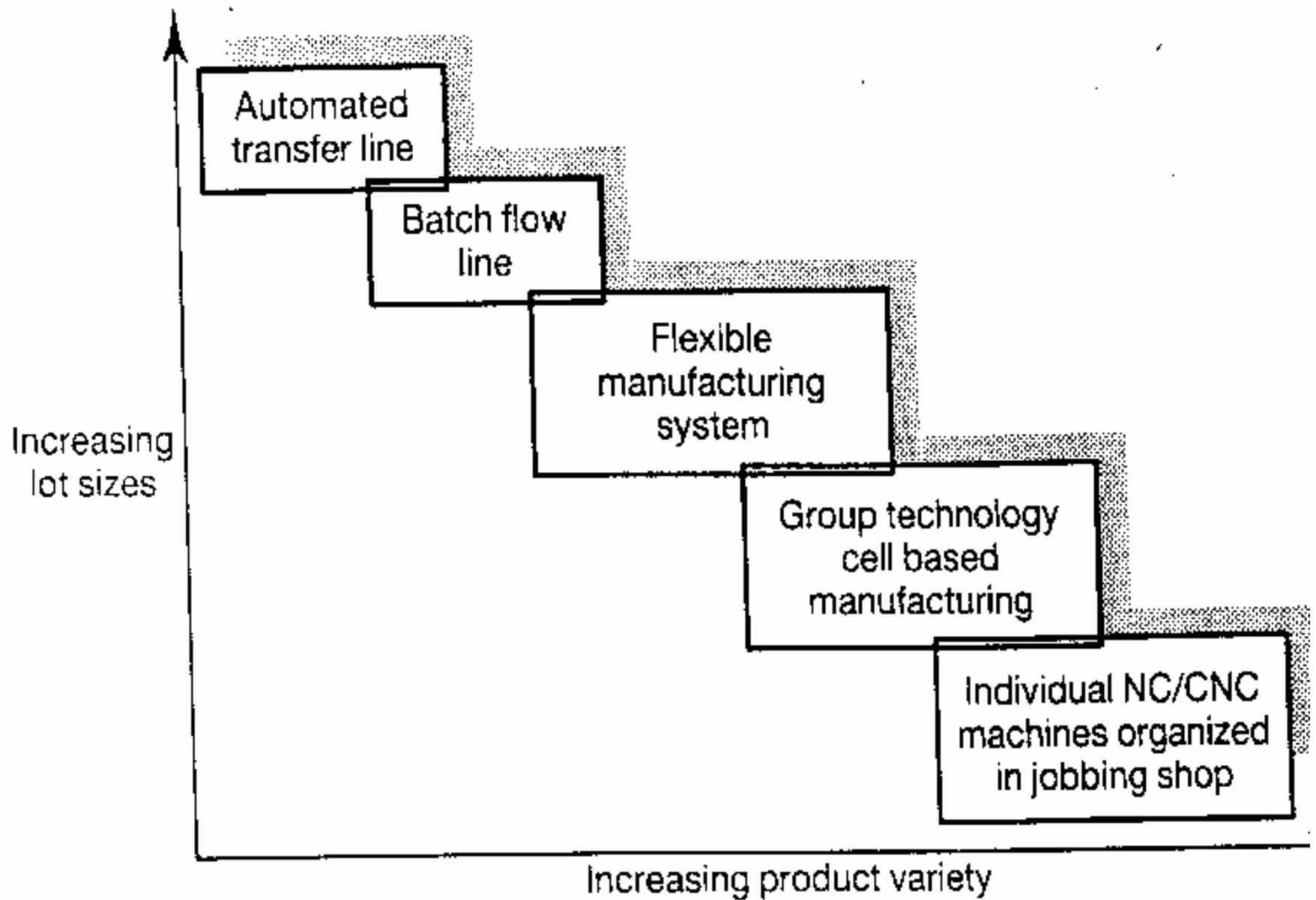


Characteristics of Types of Process Organizations

	Mass production	Batch production	Jobbing shop production
Production volumes	High	Medium	Low
Labour skills	Low	Medium	High
Specialized equipment and tooling	High	Medium	Low



*Product areas where the IMPS strategy has been effectively implemented.



High
↑
Process
decoupling
↓
Low

Jobbing shop	Batch flow line
FMS Craftsman	Group technology cell JIT Mass production Continuous process

Low ← Product
focus → High

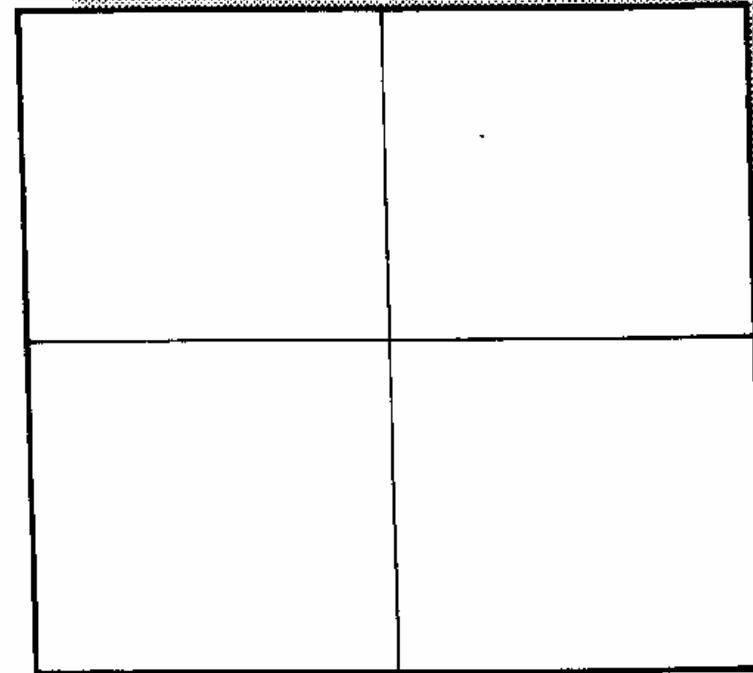
High

Large WIP inventory
Long lead time

Process
decoupling

Simpler WIP control
Low lead time
Low WIP inventory
Predictability
Flexibility
Ease of PMS

Low



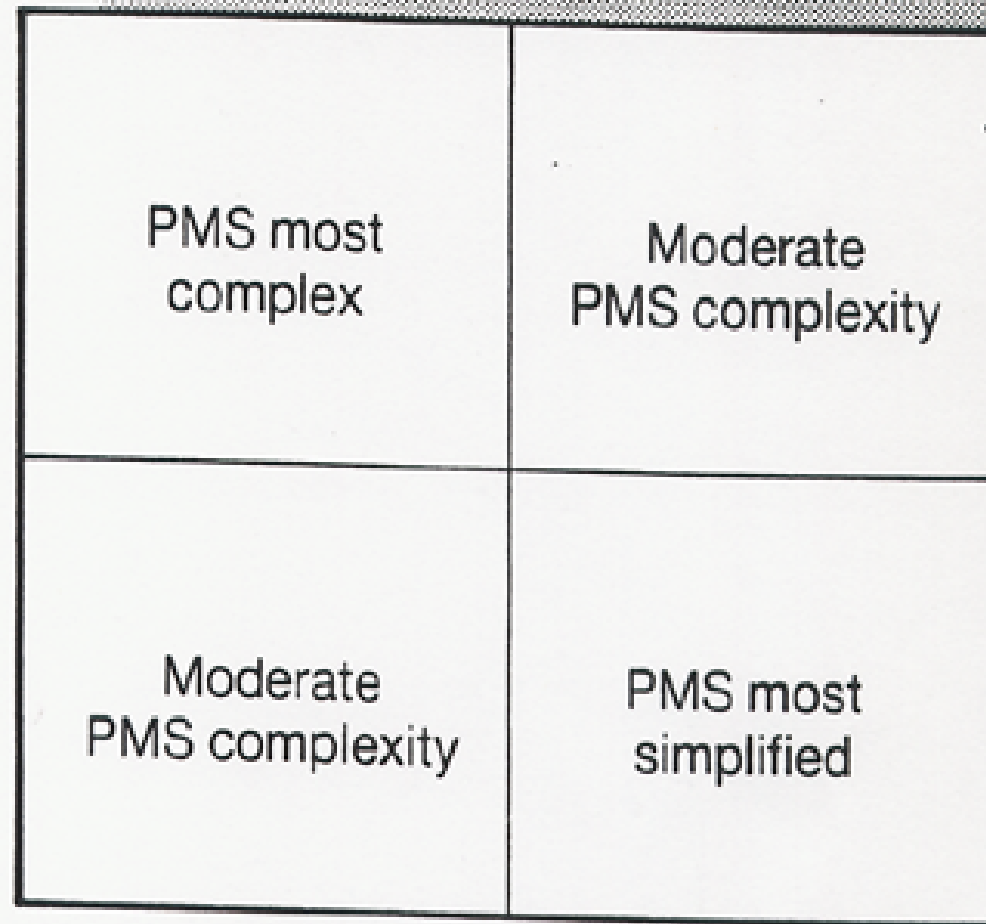
Low ← Product focus → High

Mix flexibility:
Product introduction:
Labour skill required:
Ease of PMS:

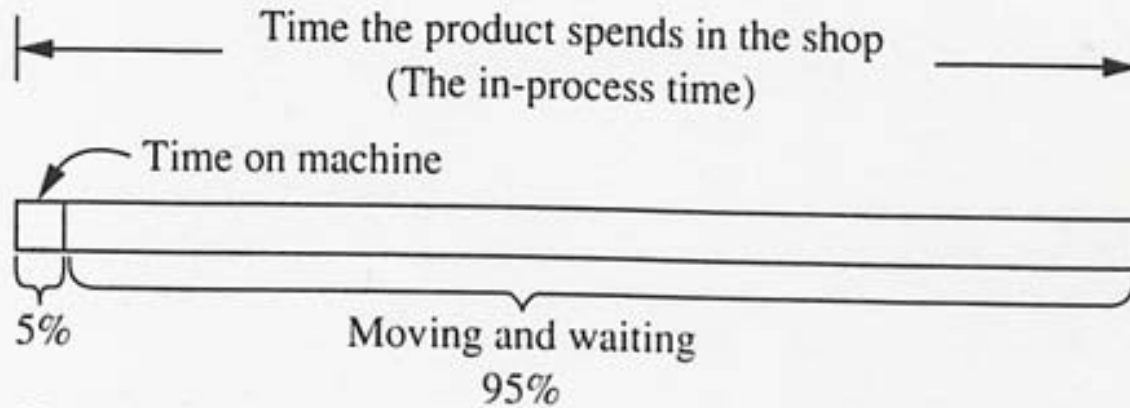
Higher
Easier
Higher
Difficult

Lower
Difficult
Lower
Easier

High
↑
Process
decoupling
↓
Low

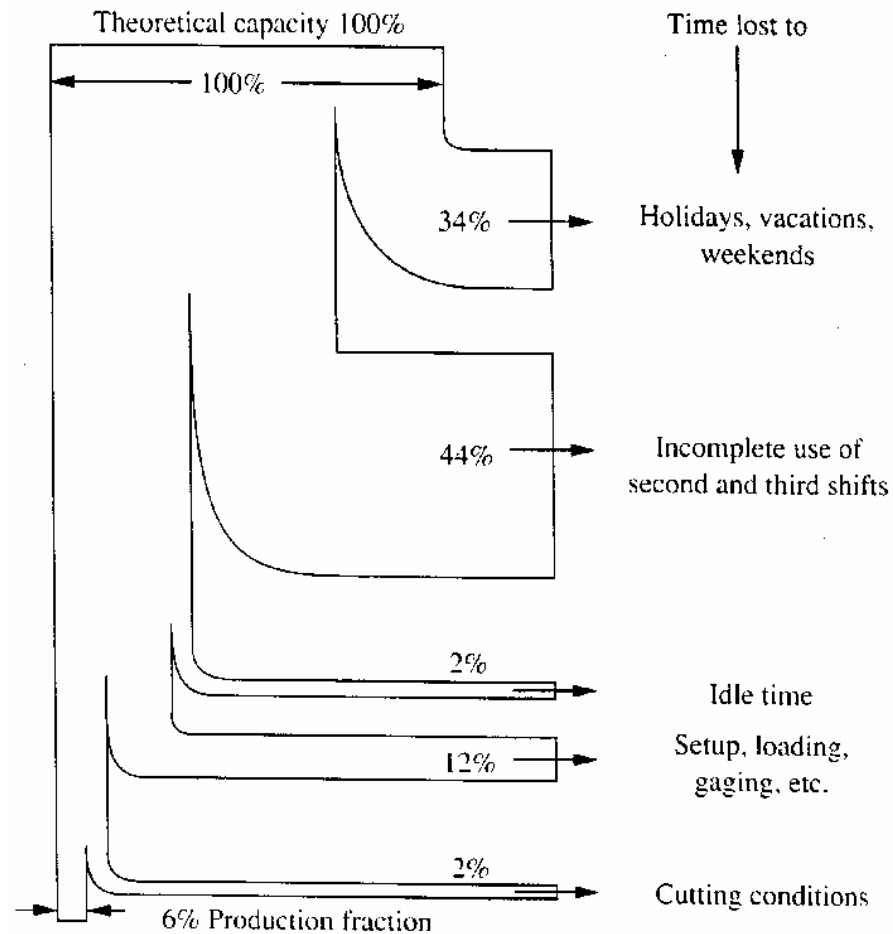


Low ← Product focus → High



How the 5% is spent

14%	Setup time needed to change tooling for different parts
17%	Location/unloading the workpiece
17%	Tool change for different operations
16%	Inspection and deburring
36%	Actual cutting (adding value)

**FIGURE 2-7**

Distribution of total factory capacity of machine tools in the job shop. Typical values are shown. (Carter, C.F. *Mfg. Eng.*, Aug. 82.)

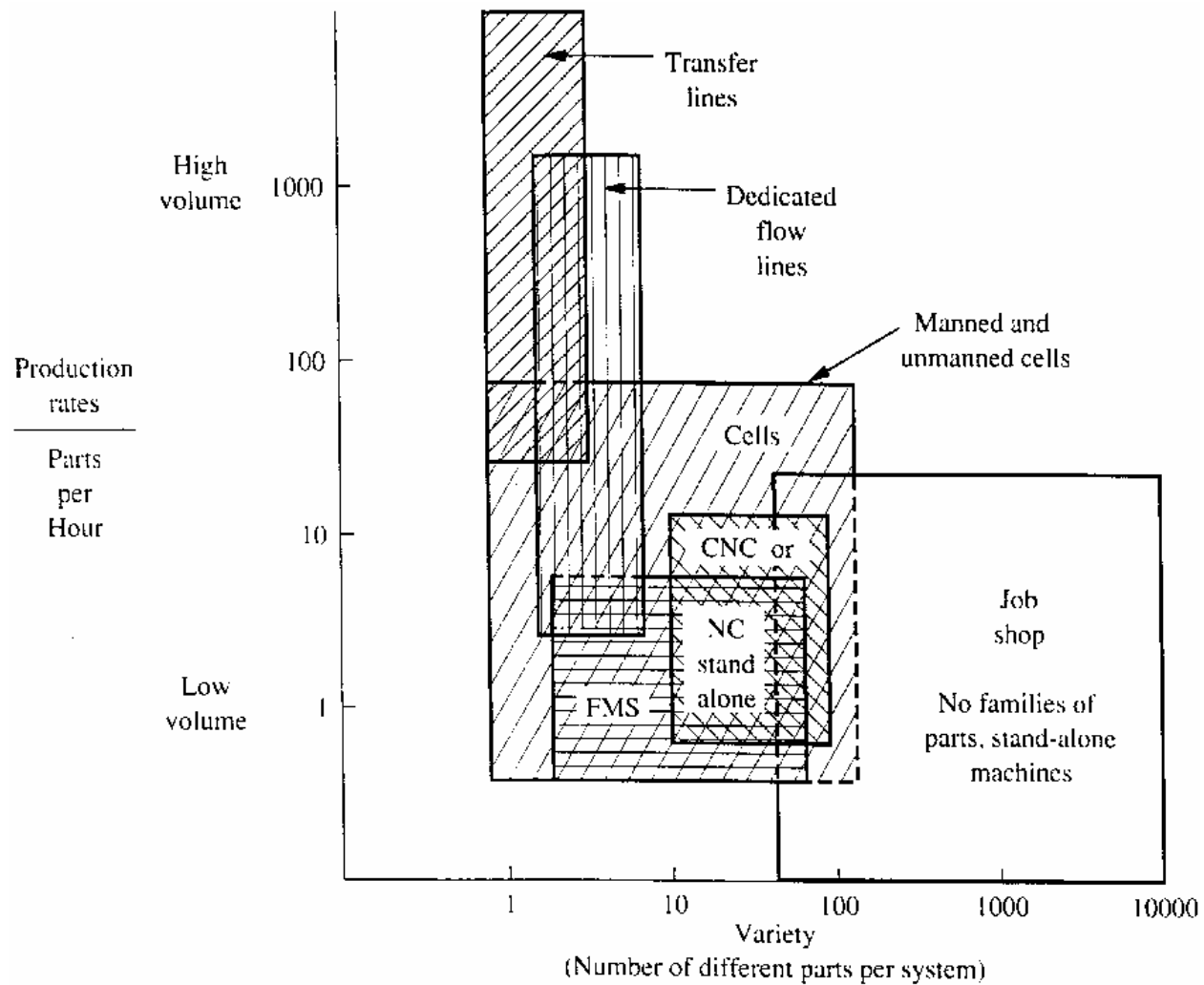


FIGURE 2-15

A comparison of different kinds of manufacturing systems with cells.

Work Organizations

- Job Shop
- Flow Shop
- Linked Cell
- Project
- Continuous Process

Job Shop

- A facility capable of producing a wide variety of products in very small volumes.
- The production facility is general purpose and flexible enough to meet a variety of needs.

Job Shop Characteristics

- Wide variety of products
- Small lot sizes (one of a kind)
- Done to customer orders or for finish goods inventory
- General purpose machines
- Skilled workers
- Low productivity
- Functional grouping
- Scheduling and process plan by route sheets

Assembly Line / Flow Shop

- A Process where discrete parts are put together to make a finished product.
- It is a high volume operation that produces products that are very similar in features and performance.
- Items are produced in a continuous manner, with usually only one possible routing.
- It is often highly automated

Assembly Line / Flow Shop Characteristics

- Most productive
- Product oriented layout
- Typically a line of dissimilar machines are grouped in the line (sometimes more than one to balance flow)
- Plant often designed for a single product line – this leads to high risk
- Line balancing is a key
- Very inflexible

Batch Process

- A process that does not have sufficient volume from a single product to fully use the facility.
- Common components are made in volume and used to form products as needed

Batch Process Characteristics

- Functional layout
- Components manufactured in “large” batches and stored
- Complicated scheduling / routing

Cellular Manufacturing / Group Technology

- The grouping together of parts or products into families by processing operations so that all members of a family are processed in a miniature factory called a cell.

Cellular Manufacturing / Group Technology Characteristics

- Cellular layout, grouped to make one product family
- Machines in cells are linked
- Often in U shape
- Manufacture one item at a time
- Multi skilled work team
- Operators stand & walk
- Machines are smaller, slower, older, flexible

Table 4.1 *Procedural Guide for Combining Workstations in Planning Departments*

If the Product Is	The Type of Planning Department Should Be	And the Method of Combining Workstations into Planning Departments Should Be
Standardized and has a large stable demand.	Production line, product department.	Combine all workstations required to produce the product.
Physically large, awkward to move, and has a low sporadic demand	Fixed material location, product department	Combine all workstations required to produce the product with the area required for staging the product
Capable of being grouped into families of similar parts that may be produced by a group of workstations	Product family, product department	Combine all workstations required to produce the family of products
None of the above	Process department	Combine identical workstations into initial planning departments and attempt to combine similar initial planning departments without obscuring important interrelationships within departments

Table 7.1 Advantages and Limitations of Fixed Product Layout, Product Layout, Group Layout, and Process Layout

Fixed Product Layout	
Advantages	Limitations
1. Material movement is reduced.	1. Personal and equipment movement is increased.
2. When a team approach is used, continuity of operations and responsibility results.	2. May result in duplicate equipment.
3. Provides job enrichment opportunities.	3. Requires greater skills for personnel.
4. Promotes pride and quality because an individual can complete the "whole job."	4. Requires general supervision.
5. Highly flexible; can accommodate changes in product design, product mix, and production volume.	5. May result in increased space and greater work-in-process.
	6. Requires close control and coordination in scheduling production.

Process Layout

Advantages

Limitations

- | Advantages | Limitations |
|---|---|
| 1. Increased machine utilization. | 1. Increased material handling requirements. |
| 2. General-purpose equipment can be used. | 2. More complicated production control required. |
| 3. Highly flexible in allocating personnel and equipment. | 3. Increased work-in-process. |
| 4. Lower equipment investment. | 4. Longer production times. |
| 5. Diversity of tasks for personnel. | 5. Higher skills required to accommodate diversity of tasks required. |
| 6. Specialized supervision is possible. | |

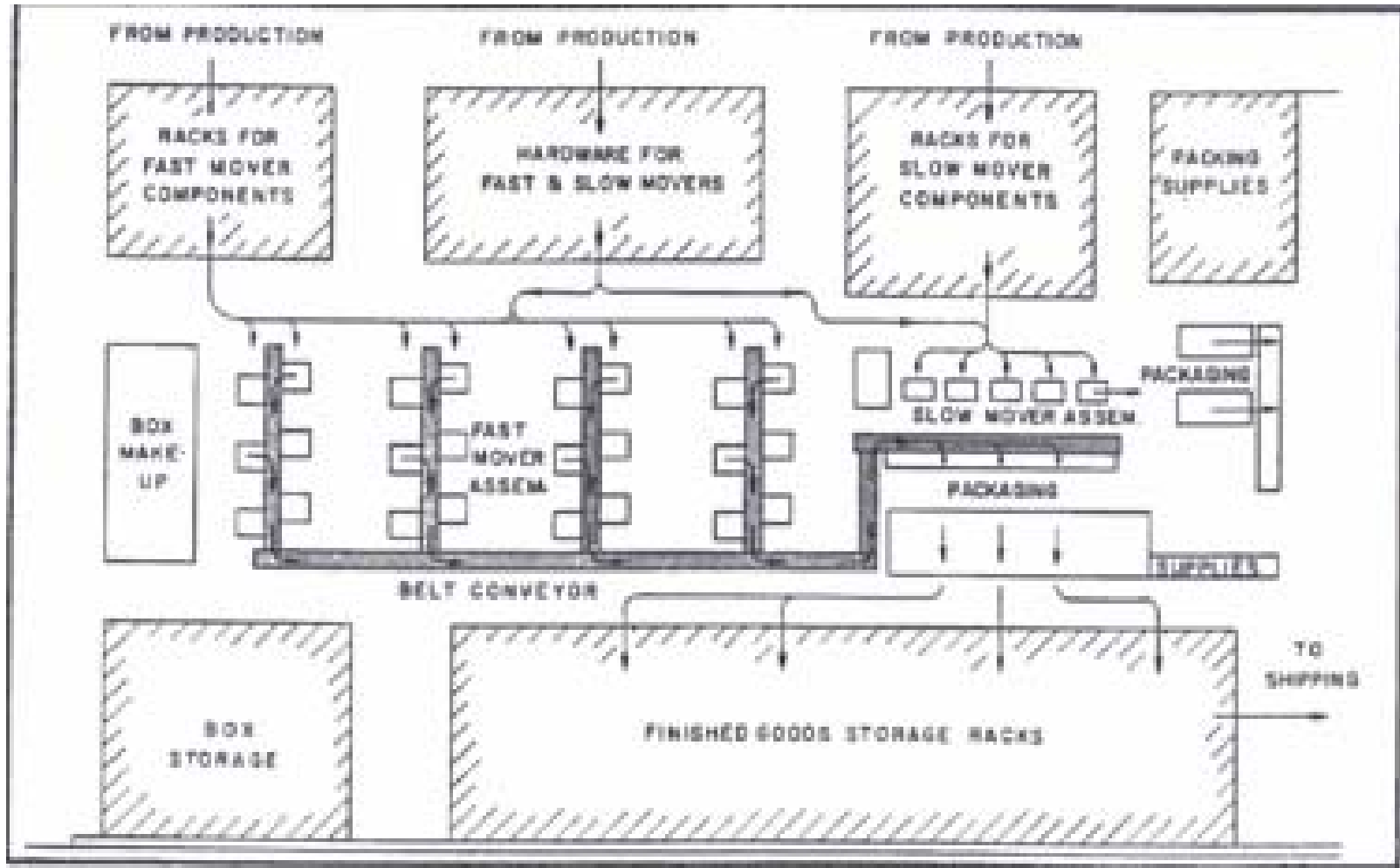
Product Layout

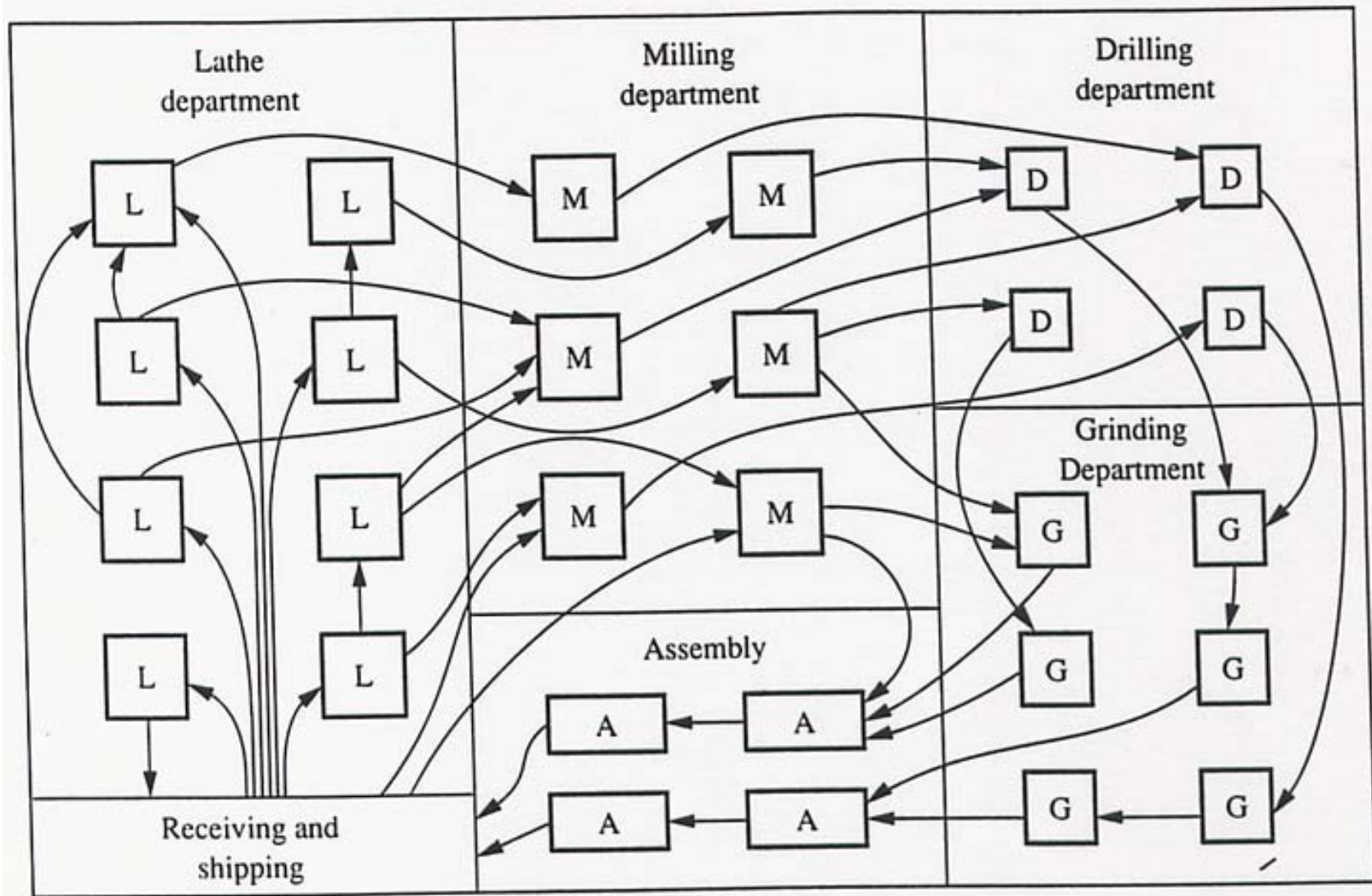
Advantages

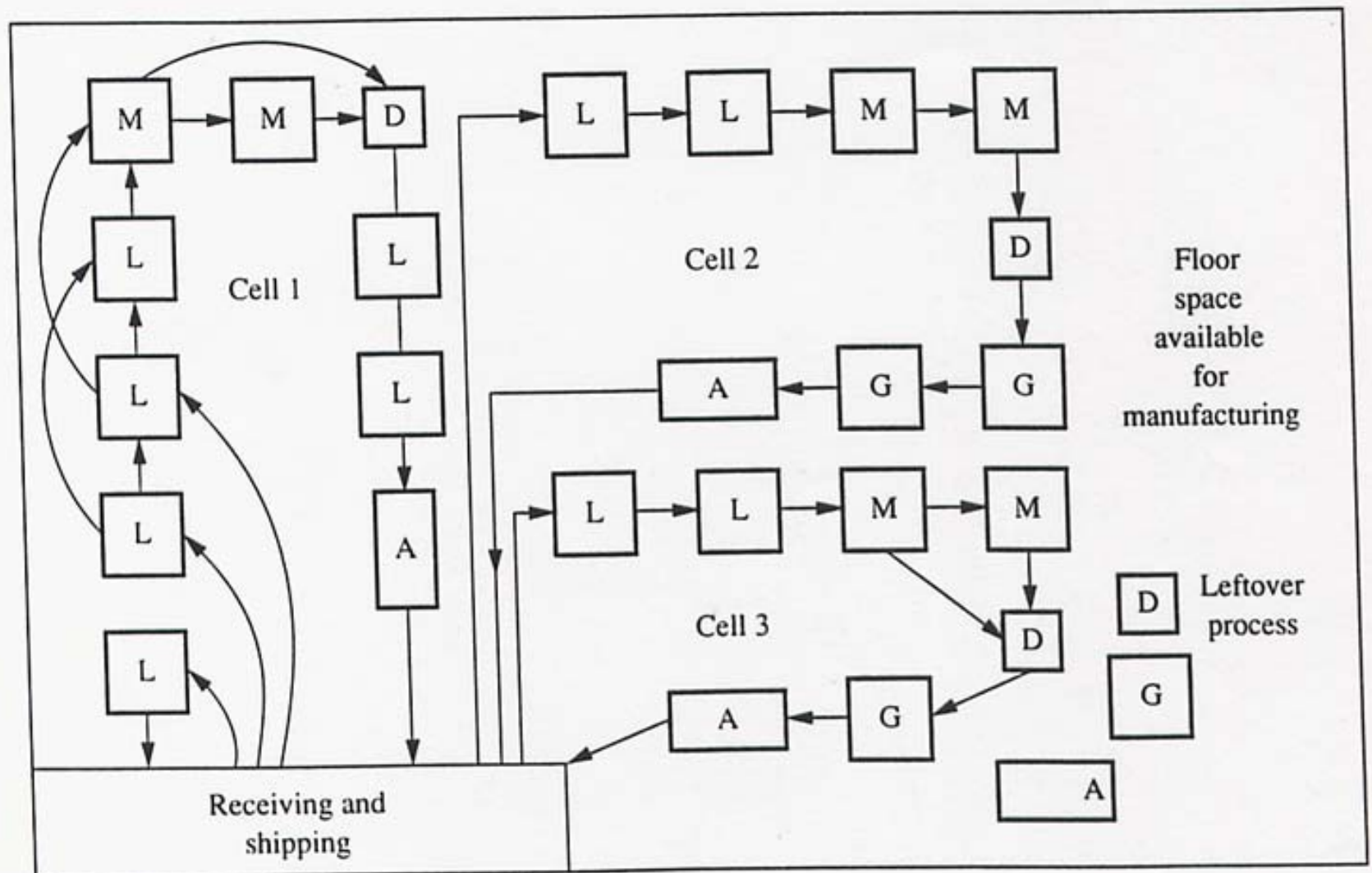
Limitations

1. Smooth, simple, logical, and direct flow lines result.
2. Small work-in-process inventories should result.
3. Total production time per unit is short.
4. Material handling requirements are reduced.
5. Less skill is required for personnel.
6. Simple production control is possible.
7. Special-purpose equipment can be used.

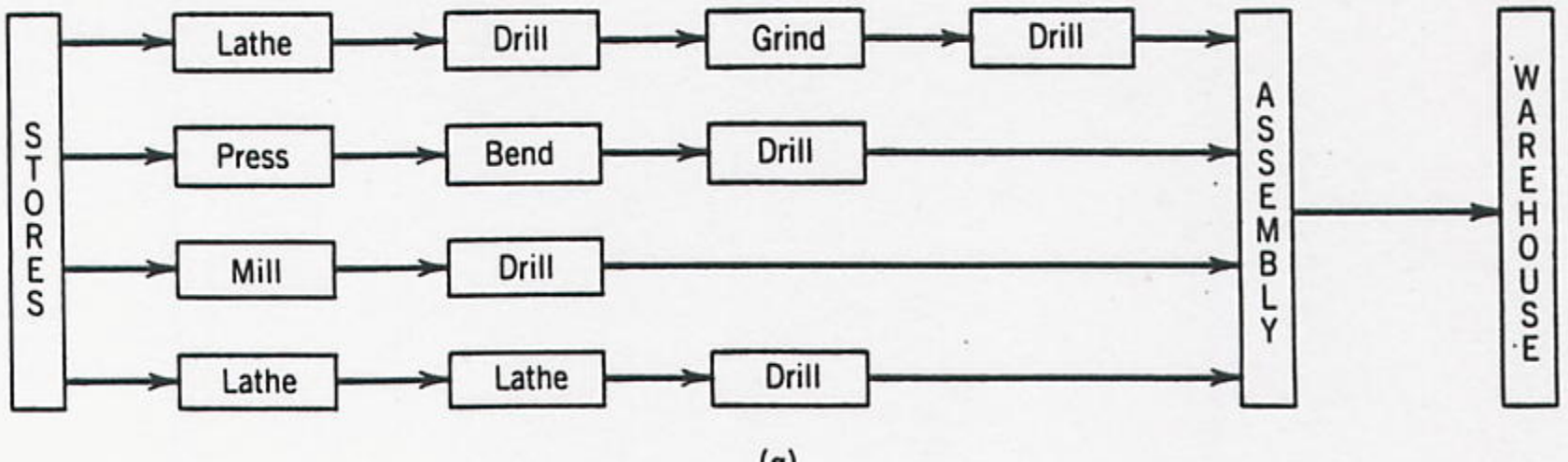
1. Machine stoppage stops the line.
2. Product design changes cause the layout to become obsolete.
3. Slowest station paces the line.
4. General supervision is required.
5. Higher equipment investment usually results.



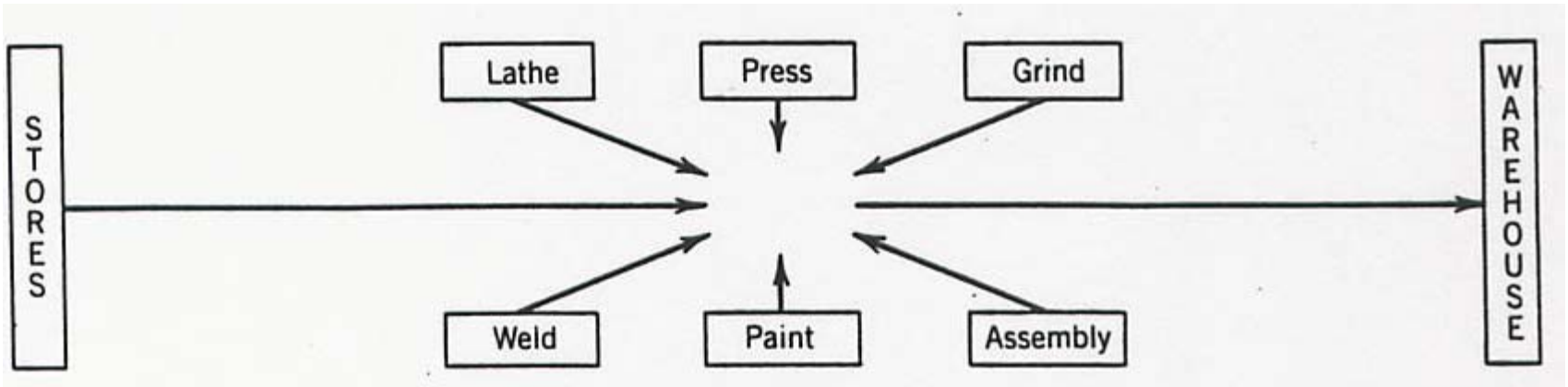




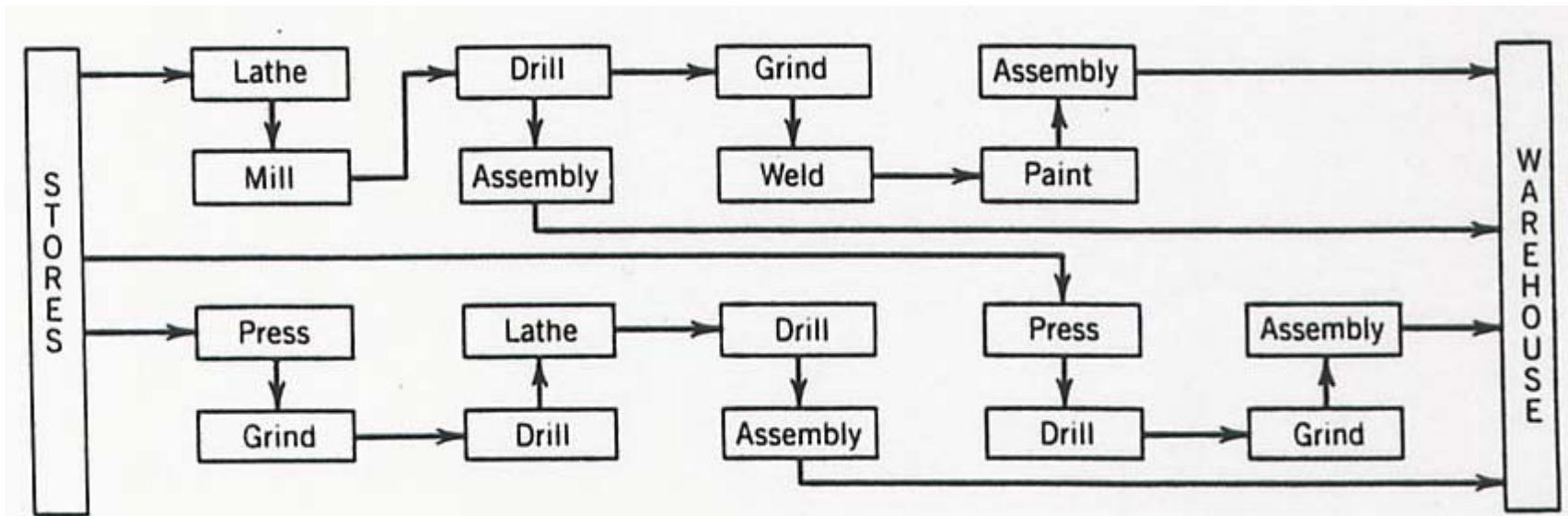
What Work Organization ???



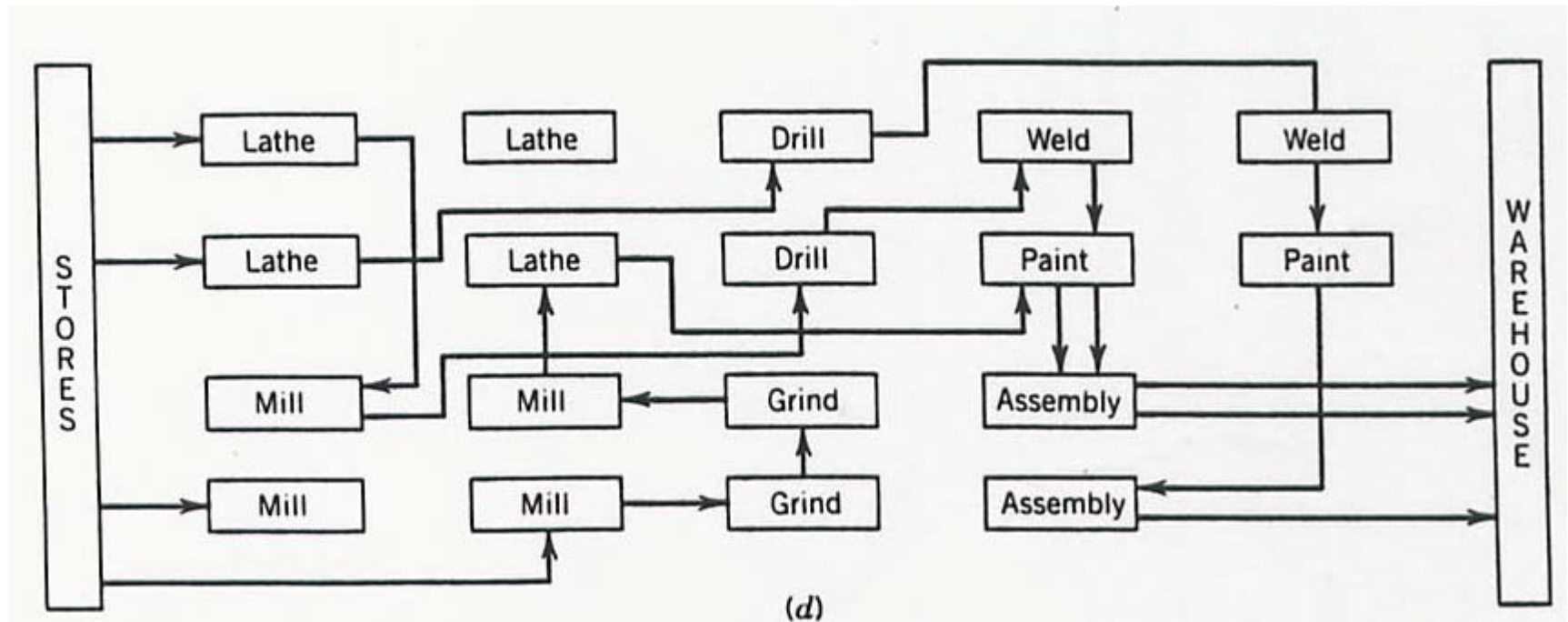
What Work Organization ???



What Work Organization ???



What Work Organization ???



Manufacturing System Hierarchy

- Production System
- Manufacturing System
- Manufacturing Process
- Job or Work Station
- Operation or Process
- Tool or Tooling

Production System

The entire company: All aspects of people, machines, materials, and information considered collectively

Manufacturing System

A series of manufacturing processes resulting in specific end products; the arrangement or layout of all processes, equipment, and people.

Manufacturing Process

A specific piece of equipment designed to accomplish specific processes.

Job or Work Station

A collection of or sequence of operations done on machines or a collection of tasks performed by one worker at one location on an assembly line.

Operation or Process

A specific action, the collection of which makes up the job of a worker.

Tool or Tooling

The implements used to hold, cut, shape, or form the work materials, such as cutting tools, jigs and fixtures, punches and dies, etc.